

Inclined-Bottom Filter for Improved Solid Removal

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What is the problem/challenge that is being solved?

In conventional radial-flow separators (RFS), significant amounts of fish waste solids tend to accumulate on the flat bottom of the filter. In the system observed in the ADC Living Lab, these solids were not fully removed through the laterally installed bottom outlet. As a result, deposits built-up over time, with some floating on the surface and create low-oxygen or fully anaerobic zones in the lower and upper part of the filter.

This is problematic in aquaponic and RAS systems because nitrifying bacteria require well-oxygenated conditions to function properly. The formation of anaerobic zones disrupts nitrification, leading to unstable water parameters and reduced plant performance. The onset of anaerobic processes was clearly visible through rising gas bubbles and the formation of a dark, foamy layer on the filter surface, which are clear indicators of organic decay.

If left unresolved, these conditions reduce filtration efficiency, weaken overall system performance, and can cause stress or disease in fish.

What is the solution developed in our LL?

To solve this problem, a filter with an inclined bottom was developed and tested. Instead of a flat base, the filter has a permanently sloped inner surface that guides solids toward the outlet.

A 200-liter plastic barrel was set at an angle of about 45 degrees and partly filled with concrete to form a smooth, even slope inside the filter. This design prevents solids from settling across the bottom. Instead, they continuously move to the lowest point, where they can be easily discharged.

As a result, solids do not stagnate, anaerobic zones are avoided, and nitrification remains stable. Water quality improves, reducing stress on both fish and plants. The system is robust, low-cost, and suitable for low-resource settings, as it uses simple materials, requires no moving parts, and is easy to build.

How was the filter constructed?

Construction was carried out in the following steps:

1. A hole was drilled approximately 7–10 cm above the bottom of a 200-liter plastic barrel.
2. A bulkhead fitting was installed in the hole to serve as the solids outlet.
3. A 30 cm long, 1-inch diameter PVC pipe was inserted through the fitting and fixed securely.
4. The barrel was then stabilized at a 45-degree angle.
5. Concrete was poured into the barrel and carefully shaped to form a smooth, uniform sloped surface.
6. The concrete was left to cure for 4–5 days.
7. After curing, a 45-degree downward-facing fitting was installed on the inside end of the outlet pipe.

8. An additional PVC pipe was attached to this fitting and extended to the lowest point of the filter to ensure complete removal of settled solids.
9. Once completed, the filter was integrated into the aquaponic system and operated without the need for additional maintenance beyond normal solids discharge.

Materials required

- 200-liter plastic barrel
- Bulkhead fitting
- 1-inch PVC pipe and fittings
- Standard drilling tools
- Concrete mix (The ideal mixture is 75kg of Portland cement (CEM II) to 10kg of sand for a filtration barrel. The surface of the concrete should be very smooth with no rough patches)

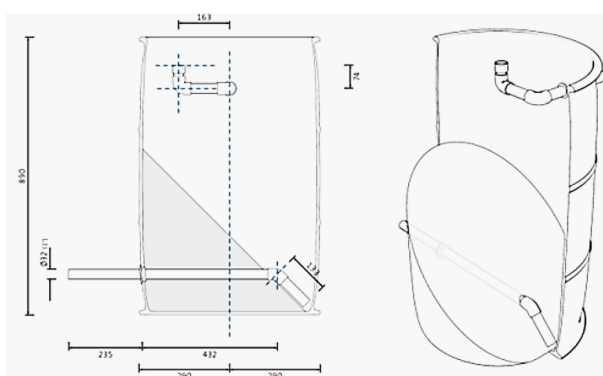


Figure 1: Cross-section of the filter



Figure 2: Filter seen from inside



Figure 3: Filter connected to the overall system